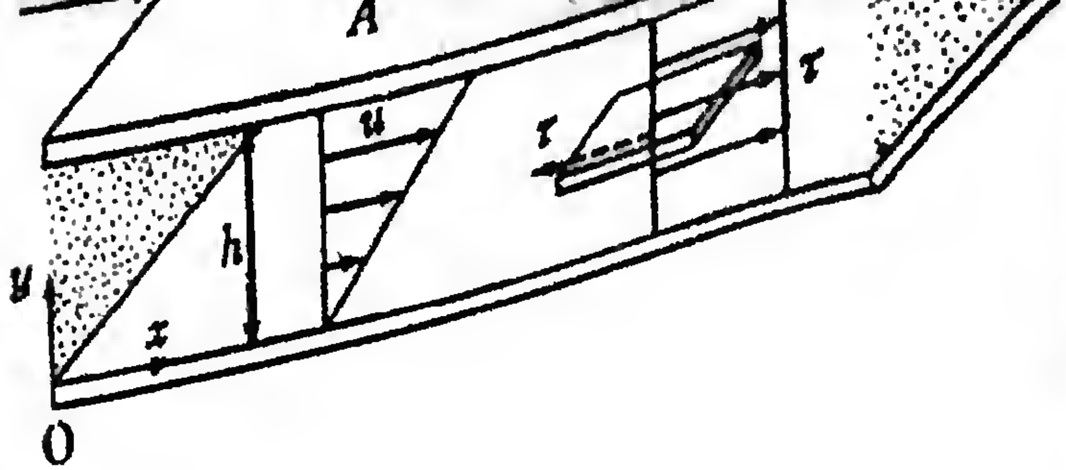

The shear stress is found from Eq.

$$\tau = \mu \frac{du}{dy} = \frac{\mu u}{h}$$

From Table (1.5) for SAE 30 oil, $\mu = 0.29$ kg/(m . s).

Then, for the given values of u and h, Eq. (E1.1) predicts

$$\tau = \frac{[0.29\,kg/(m.s)](3\,m/s)}{0.02\,m} = 43\,kg/(m.s^2) = 43\,N/m^2 = 43\,Pa$$

Sheet (1)

1. Derive the SI unit of force from base units.

2. Express the viscosity and the kinematics' viscosity in SI units.

(٢)

$\tau = \mu \frac{u}{h} =$

3. The density of water at 4°C and 1 atm is 1000 kg/m^3. Obtain the specific volume.

4. The specific weight of a certain liquid is 10 KN/m^3. Determine its density and specific gravity.

صُبّ

5. A liquid when poured into a graduated cylinder is found to weigh 8 N when occupying a volume of 500 ml (milliliters). Determine its specific weight, density, and specific gravity.

6. Obtain the pressure in SI (Pa) necessary for shrinking the volume of water by 1% at normal temperature and pressure. Assume the compressibility of water $\beta = 4.85 \times 10^{-10}$ 1/Pa.

7. When two plates are placed vertically on liquid as shown in Fig. 1, derive the equation showing the increased height of the liquid surface between the plates due to capillarity. Also when flat plates of glass are used with an 1 mm gap, what is the increased height of the water surface? Given surface tension force 0.0728 N/m.

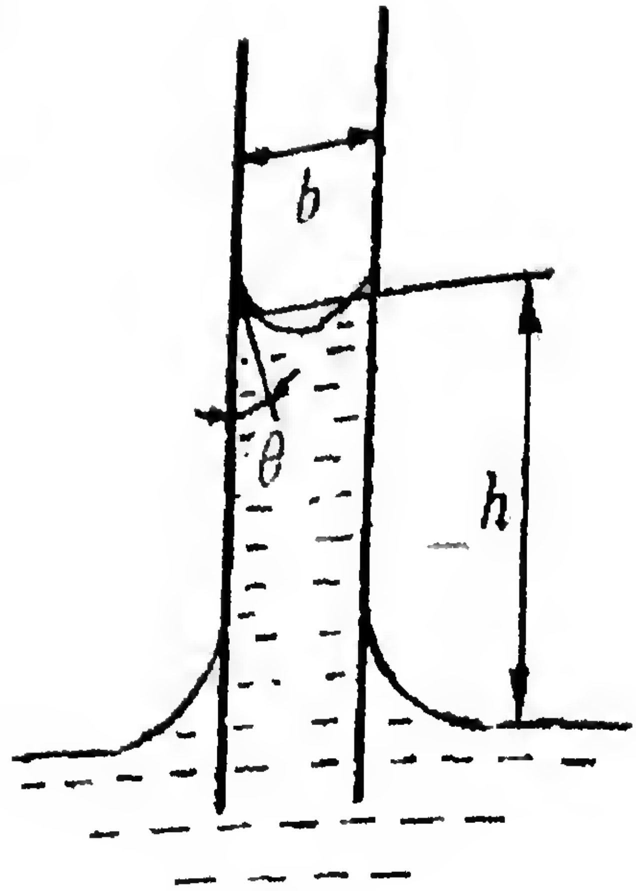

Fig 1

8. A Newtonian fluid having a specific gravity of 0.92 and a kinematics viscosity of $4 * 10^{-4}$ m^2/s flows past a fixed surface. Due to the no-slip condition, the velocity at the fixed surface is zero (as shown), and the velocity profile near the surface is shown in Fig. 2. Determine the magnitude and direction of the shearing stress developed on the plate. Express your answer in terms of U and δ, with U and δ expressed in units of meters per second and meters, respectively.

$$u = \frac{3}{2}\frac{U}{\delta}y - \frac{1}{2}U\left(\frac{y}{\delta}\right)^3$$

$$\frac{u}{U} = \frac{3}{2}\frac{y}{\delta} - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$$

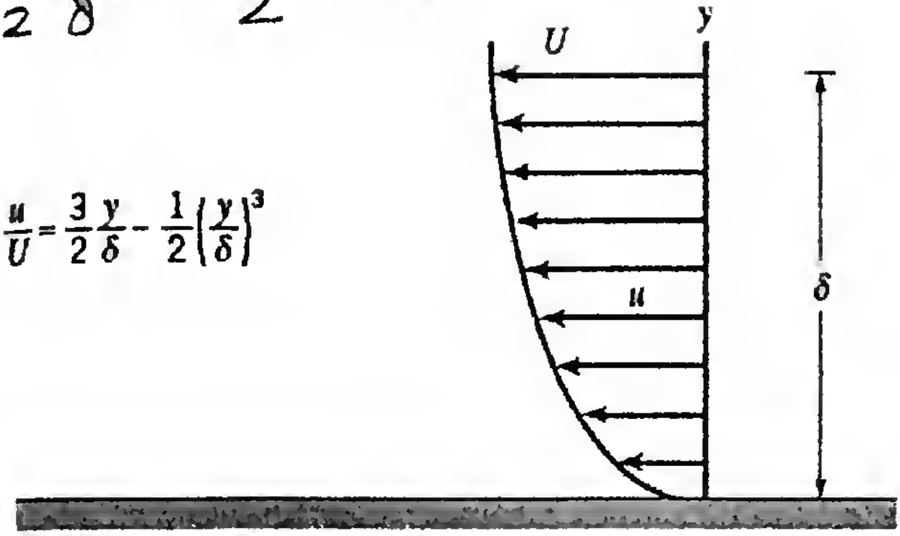

Fig. 2.

9. As shown in Fig. 3, a cylinder of diameter 122mm and length 200mm is placed inside a concentric long pipe of diameter 125 mm. An oil film is introduced in the gap between the pipe and the cylinder. What force is necessary to move the cylinder at a velocity of 1 m/s? Assume that the kinematic viscosity of oil is 30 cSt and the specific gravity is 0.9.

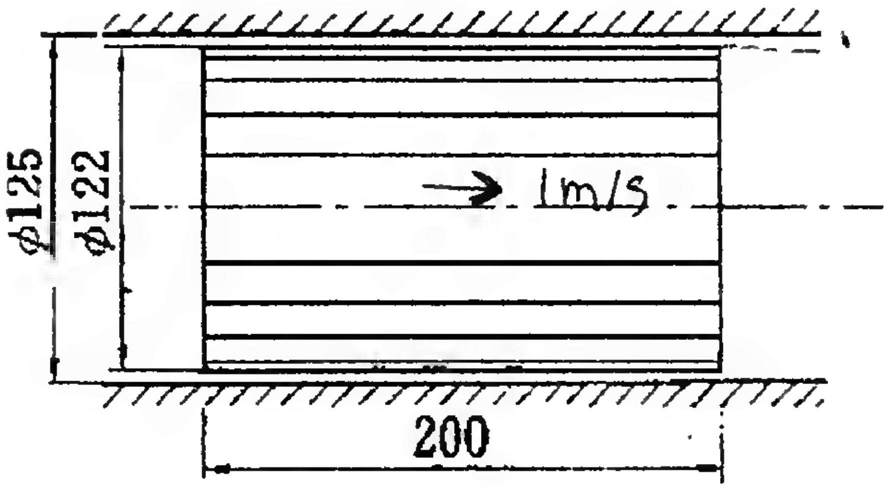

Fig 3

to ze...

$\sum M_A$ ... ng, the reaction force

Solving for F_{ridge} ...

determined to be

$$F_{ridge} = \frac{s+y_P}{AB} F_R = \frac{(1+2)\,m}{4\,m}(221\ kN) = 166\ k...$$

Sheet (2)

1. What is the water pressure on the sea bottom at a depth of 6500m?

2. Obtain the pressure p at point A in Figs 1(a), (b) and (c). Specific gravity of sea water is assumed to be 1.03.

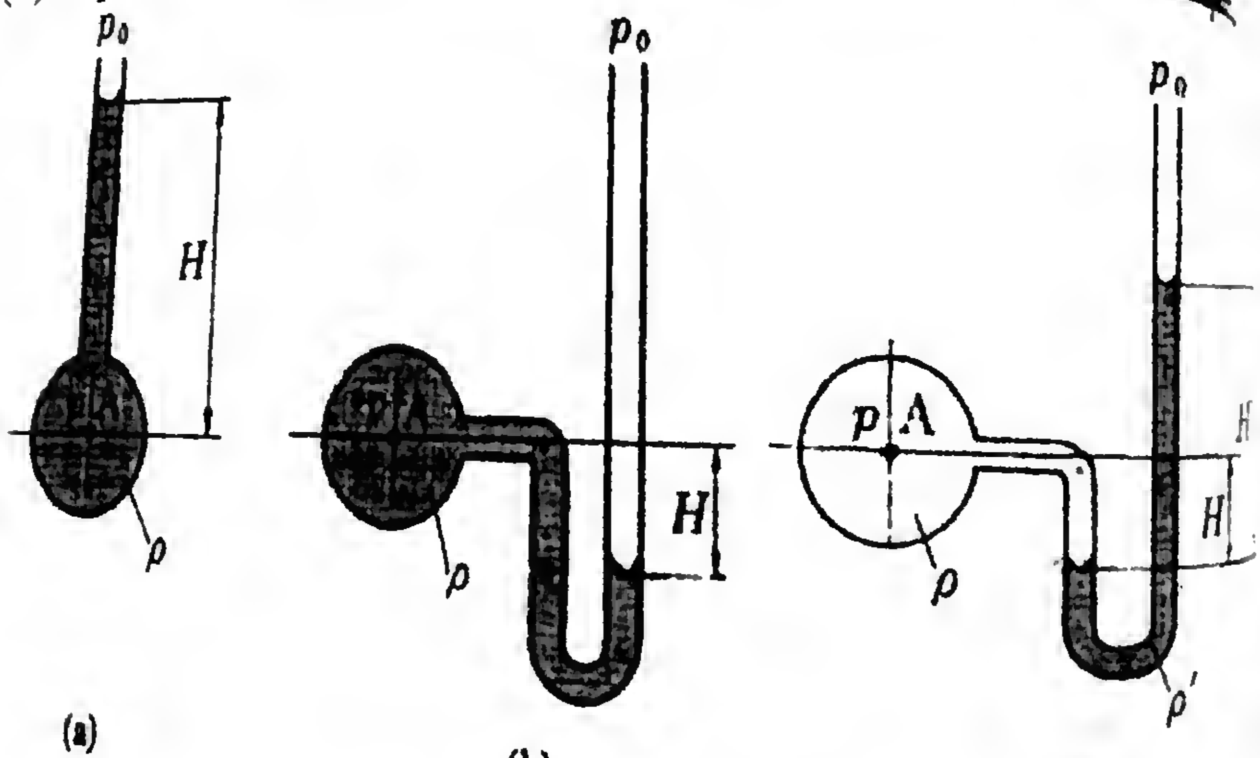

Fig (1)

3. Obtain the pressure difference p_1-p_2 in Figs 2(a) and (b).

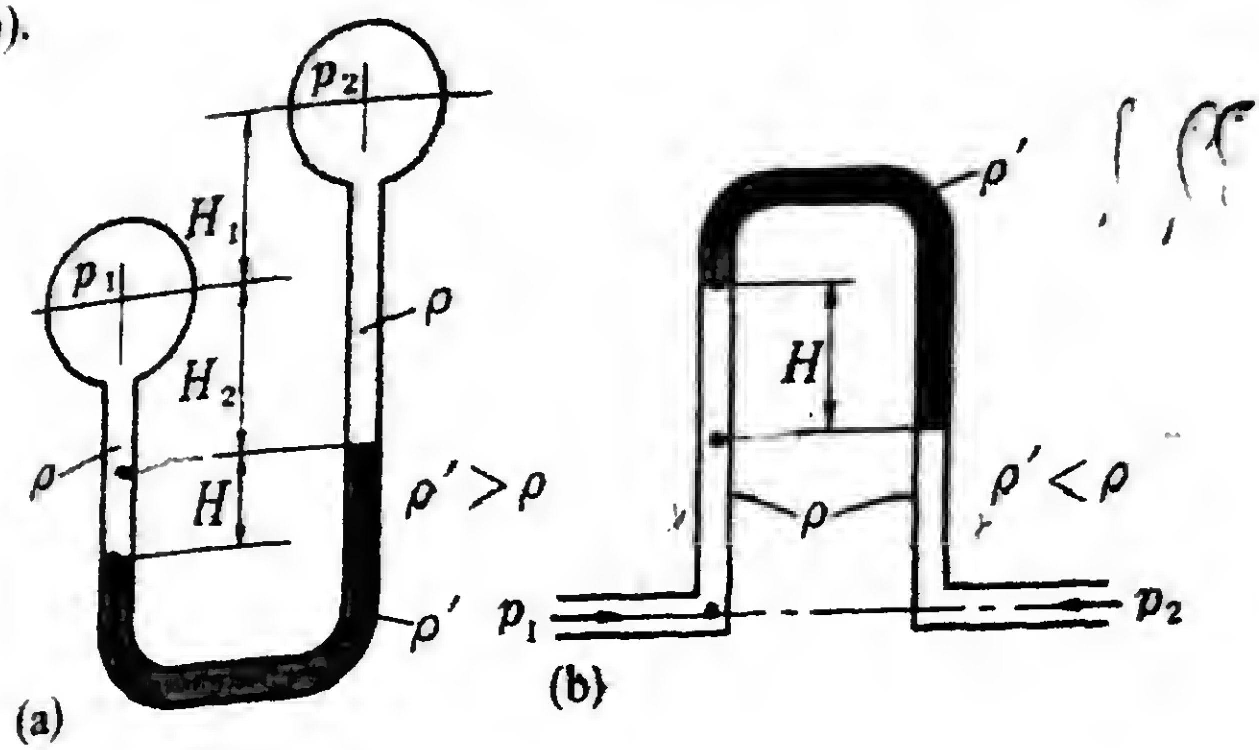

Fig (2)

4. On the inclined manometer in Fig. 3, whenever h changes by 1 mm, how high (in mm) is H? (Sectional area A = 100a and $\alpha = 30°$.)

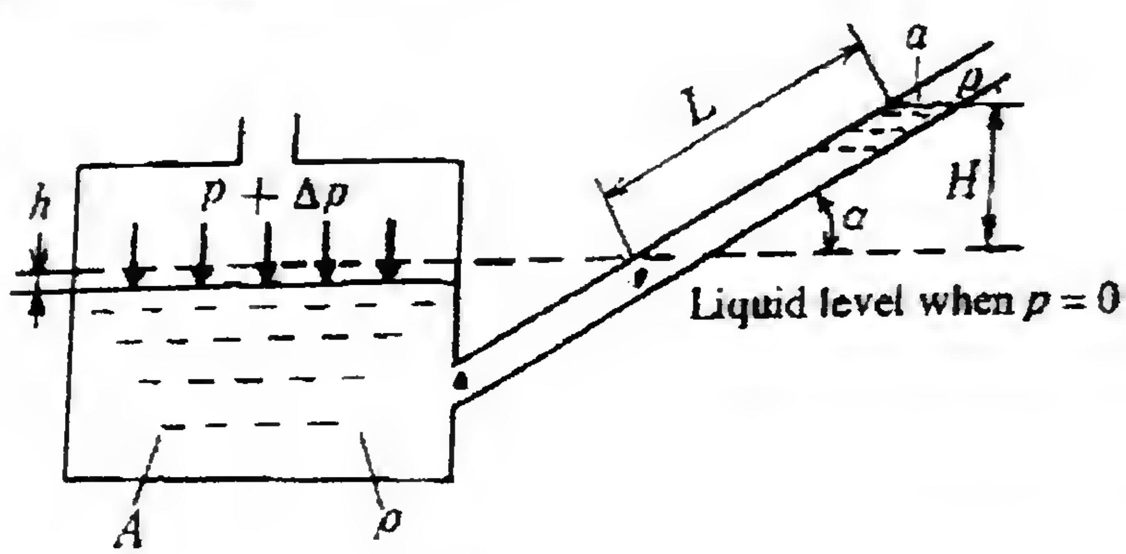

Fig (3)

5. In the case shown in Fig. 4, an oblong board 3m high and 5m wide is placed vertically in water in such a manner that its upper face is 5m deep. Obtain the

force acting on this board and the location of the centre of pressure.

6 A water gate 2m high and 1 m wide is shown in Fig. 5. What is the force acting on the lower stay?

7 What is the force acting on a unit width of the dam wall shown in Fig.6 , if the water is 15m deep and the wall is inclined at 60°? Furthermore, how far along the wall from the water surface is the action point of the force?

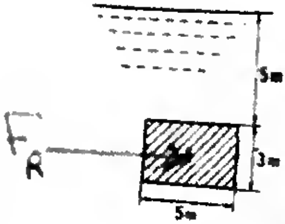

Fig. 4

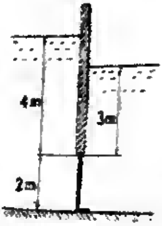

Fig. 5

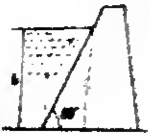

Fig. 6

8 As shown in Fig. 7, a circular water gate, diameter 2m, is supported by a horizontal shaft. What is the moment around the shaft to keep the water gate closed?

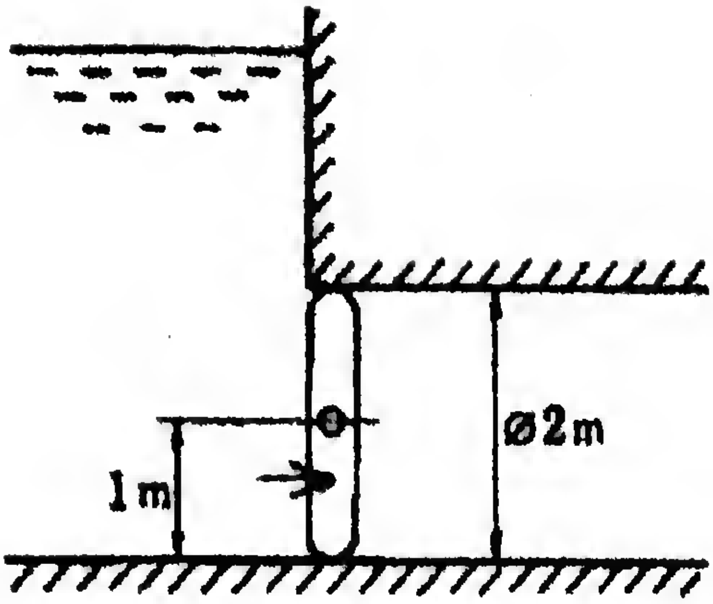

Fig. (7)